

Military Explosives and Warheads



Explosion

Definition: A reaction that produces a change in the state of matter that results in a rapid and violent release of energy.

Types:

- Mechanical
- Chemical
- Nuclear

Explosive

Definition: A material that can undergo a very rapid, self propagating decomposition, resulting in:

- a. Formation of stable materials
- b. Liberation of heat
- c. Development of a sudden pressure effect

And make a big BANG!!

Explosive “Yield”

- The amount of TNT to produce an equivalent blast (pressure) as that of the explosive itself.
 - Measured in pounds
- Tomahawk
 - 1000lb bullpup warhead
 - 1000lb of TNT to produce the same explosion
 - Warhead’s weight: 215lb

Characteristics of Military Explosives

- *Availability & Cost*
- *Sensitivity (impact, friction & heat)*
- *Stability (chemical constitution, sun, temperature)*
- *Power (or performance)*

Characteristics of Military Explosives (cont.)

- *Brisance*
- *Density*
- *Volatility*
- *Hygroscopicity*
- *Toxicity*

Chemical Explosive Reaction.

For a chemical to be an explosive, it must exhibit all of the following:

- Formation of Gases.
- Evolution of Heat.
- Rapidity of Reaction.
 - “Uncontrollable Chain Reaction”
- Initiation of Reaction.

Categories of Explosives

■ Low Explosives

- Normally employed as propellants.
- Burn rapidly (up to 400 m/s).

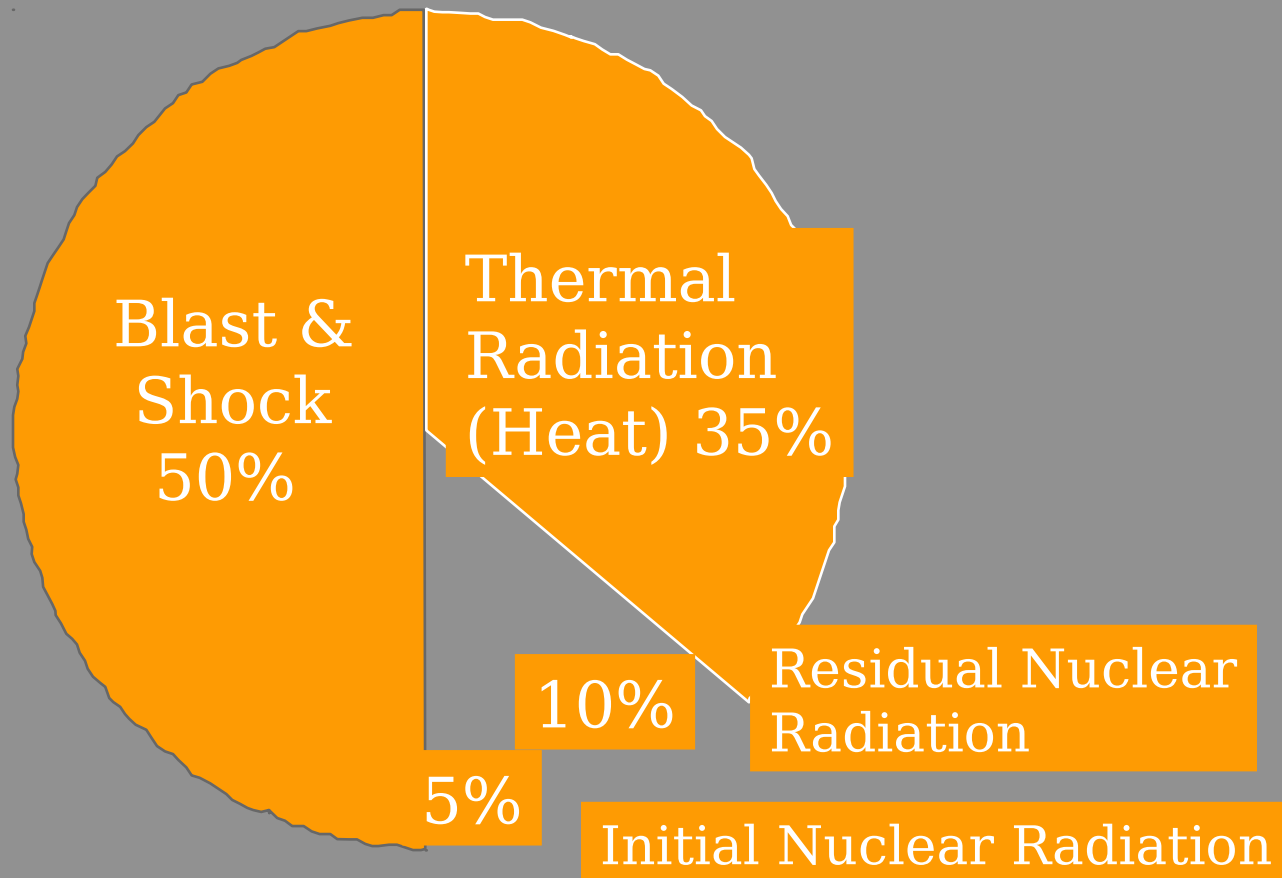
■ High Explosives

- Detonate (1000 - 8500 m/s).
- Differentiated by Sensitivity:
 - » Primary - Extremely sensitive to impact, friction & heat.
 - » Secondary - Less sensitive. (May burn in small, unconfined quantities; otherwise will detonate.)

Nuclear Explosives

- Atoms of heavy unstable isotopes are split by high speed neutrons.
- Split nucleus releases energy and more neutrons.
- These neutrons go on to split more nuclei.
- Reaction also produces heat and radiation.
- Energy released is much greater than with chemical explosives (per weight of explosive).

Energy From a Nuclear Air Burst

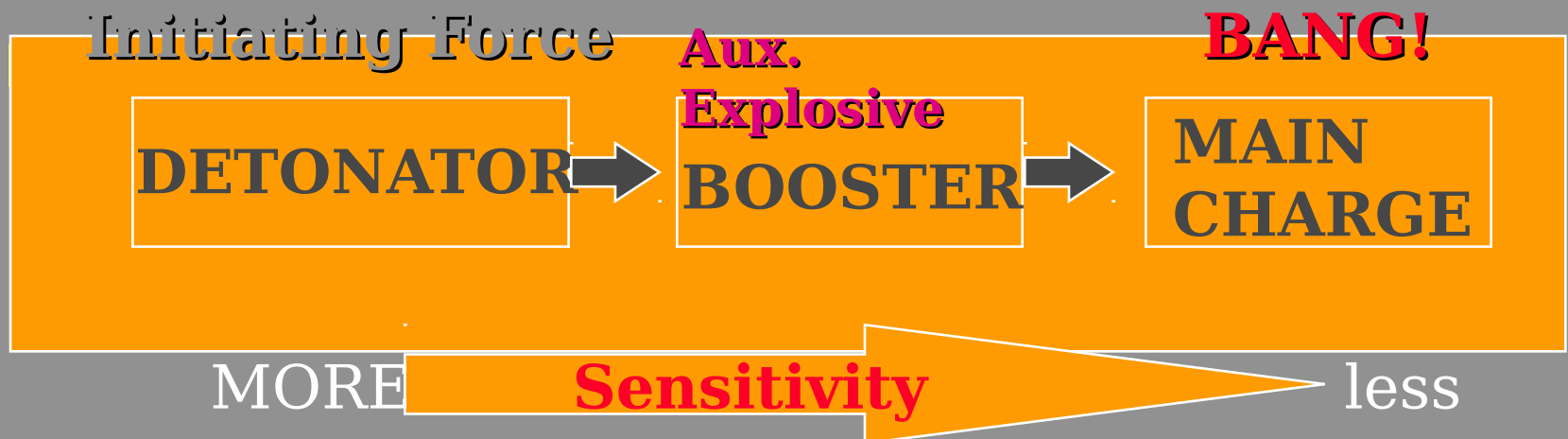


Functional Parts of Simple Warhead

- Basic purpose of a warhead is to deliver destructive power to the intended target.
- Basic warhead consists of:
 - Fuze
 - Explosive Fill
 - Warhead Case
- All make up what is known as the “Explosive Train.”

High Explosive Train

- The explosive train is a series of actions designed to make a stable material unstable through a given sequence.



Warhead Characteristics

■ Damage Volume

- Defines the destructive effectiveness of a given payload.

■ Attenuation

- A function of distance from the origin of the blast, as the blast travels outward, the energy given off is dispersed over a greater area.

■ Propagation

- How energy released from the blast spreads.
 - » (i.e. - Isotropic & Non-isotropic)

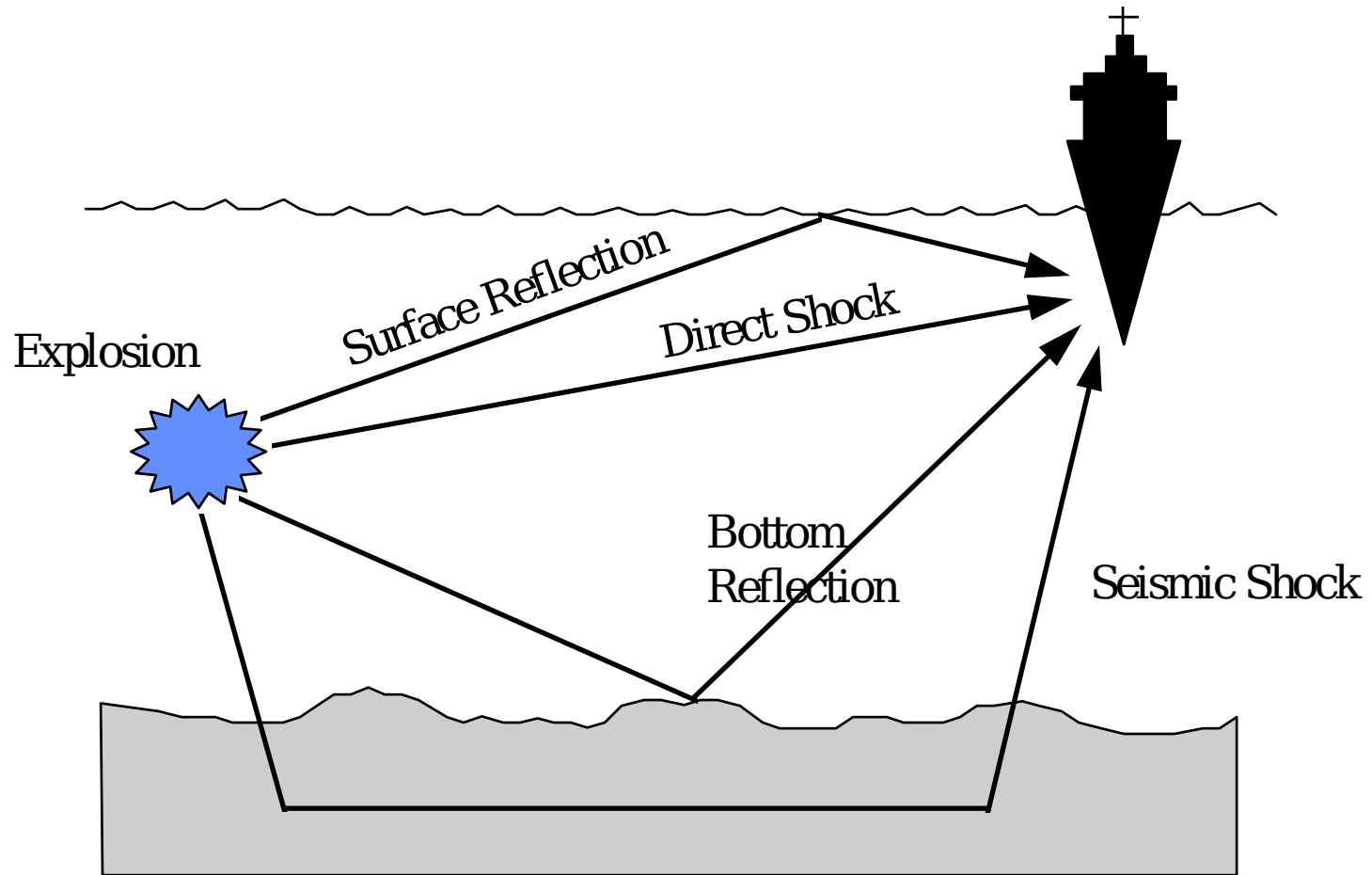
Blast Warheads

- Designed to achieve best results from the blast.
- Initial blast produces heat and overpressure.
- Followed by a suction or underpressure.
- Push/Pull causes the intended target to explode from the pressure differential.

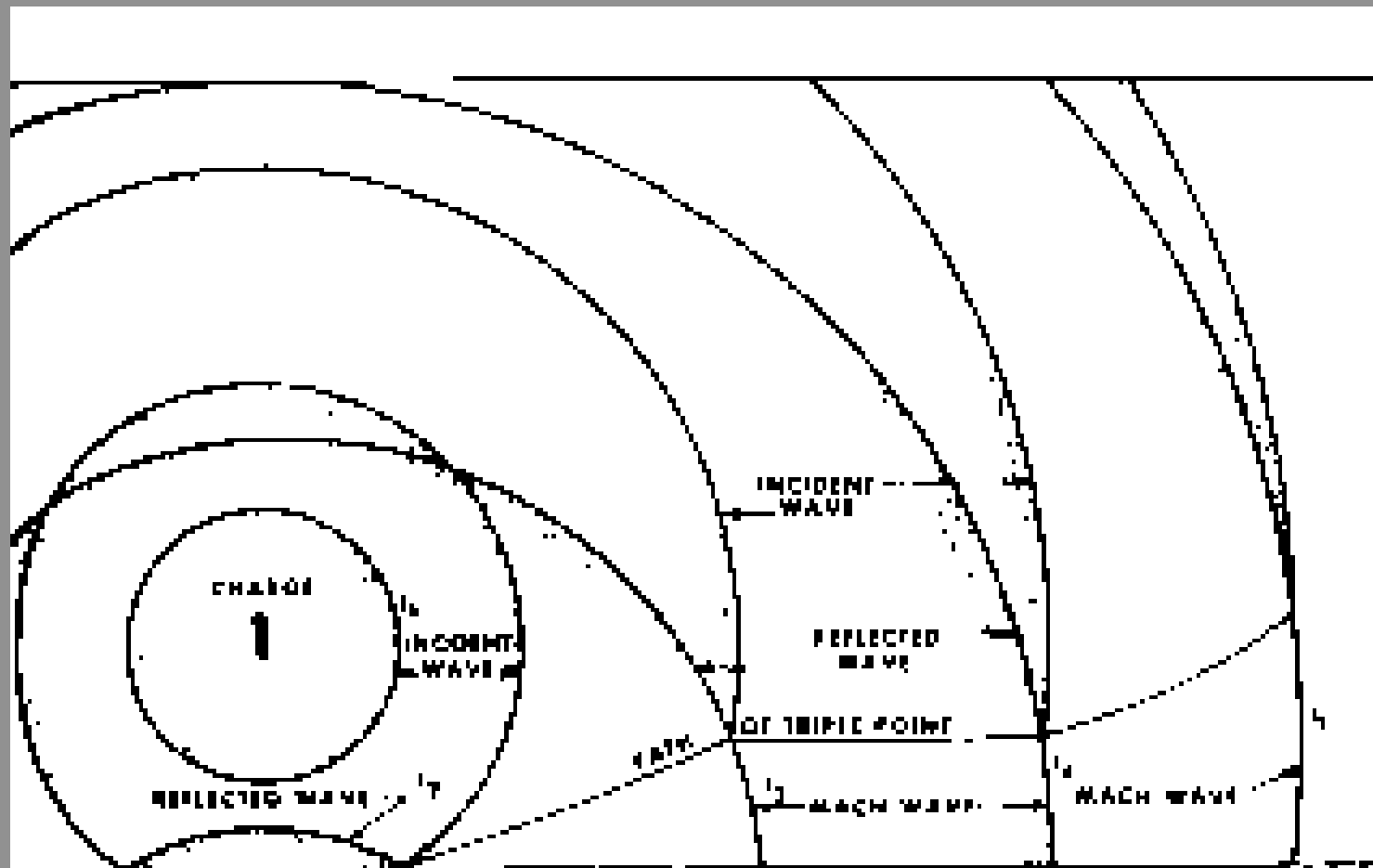
Blast Warheads Cont.

- Two types of blast waves:
 - Isotropic
 - Non-Isotropic
- Mach Effect - A third wave resulting from the reflected wave overtaking the original shock wave.
- Where the three waves combine is called the “Triple Point.”
- Triple Point can increase a blast weapon’s effectiveness/radius range.

Affect of an Underwater Blast



Blast Wave



Fragmentation Warheads

- Blast energy is translated to the fragments of the weapons casing.
- Approximately 30% of energy used to fragment the warhead.
- Fragments propelled at very high velocities.
- Exceeds the radius of a blast weapon.
- Allows for greater inaccuracies in weapon use.

Shaped Warhead (Charge)

- Weapon impacts tgt, fuze at rear of weapon ignites apex of metal cone liner.
- Cone collapses from apex forward.
- Collapse results in the ejection of a high-velocity molten jet.
- Pressure of jet >>> armor yield strength.
- The jet is followed by a slug.
- The jet liquefies some armor (*spalling*).

Shaped Charge



Continuous-Rod Warheads

- Used to damage aircraft in the event of a near miss.
- Series of rods connected and folded so that the series expands circularly.
- Doesn't produce as much destructive energy as the average fragmentation weapon.

RAM



Special Purpose Weapons

- Thermal Weapons
 - Used to start fires.
 - Napalm, etc.
- Biological & Chemical Weapons
 - Used to kill with a minimal amount of destruction.
 - Biological – Microbes, Germs, Viruses
 - Chemical – Nerve, Blood, Blistering

Special Purpose Weapons

- Nuclear
 - ThermoNuclear - Fission
 - Hydrogen - Fusion
 - Radiation Weapons - Neutron Bomb
 - EMP
- Hiroshima - yield 125kT of TNT
- Current Max Yield - 25MT of TNT (200 times!!)

Special Purpose Weapons (cont.)

- Pyrotechnic Warheads
 - Flares (for lighting or signaling).
 - Smoke
 - WP ("Willy Pete")
- Anti-Personnel Warheads
 - Designed to maim troops.
 - Projectile loaded with steel darts or wire.
- Cluster Bombs - Used for soft targets over a wide area.

Special Purpose Weapons

(cont.)

■ Mines

- Offensive and Defensive

■ Torpedoes - Homes on intended target

- Mission / Mobility Kill - Hits ships screw
- Hard Kill - explodes under ships hull

■ Anti-Tank Warheads

- Large diameter shaped charges.
- KE defeat mechanism (“cookie cutter”).
- Plastic defeat mechanism (massive spalling for lighter armor).

ASROC Launcher

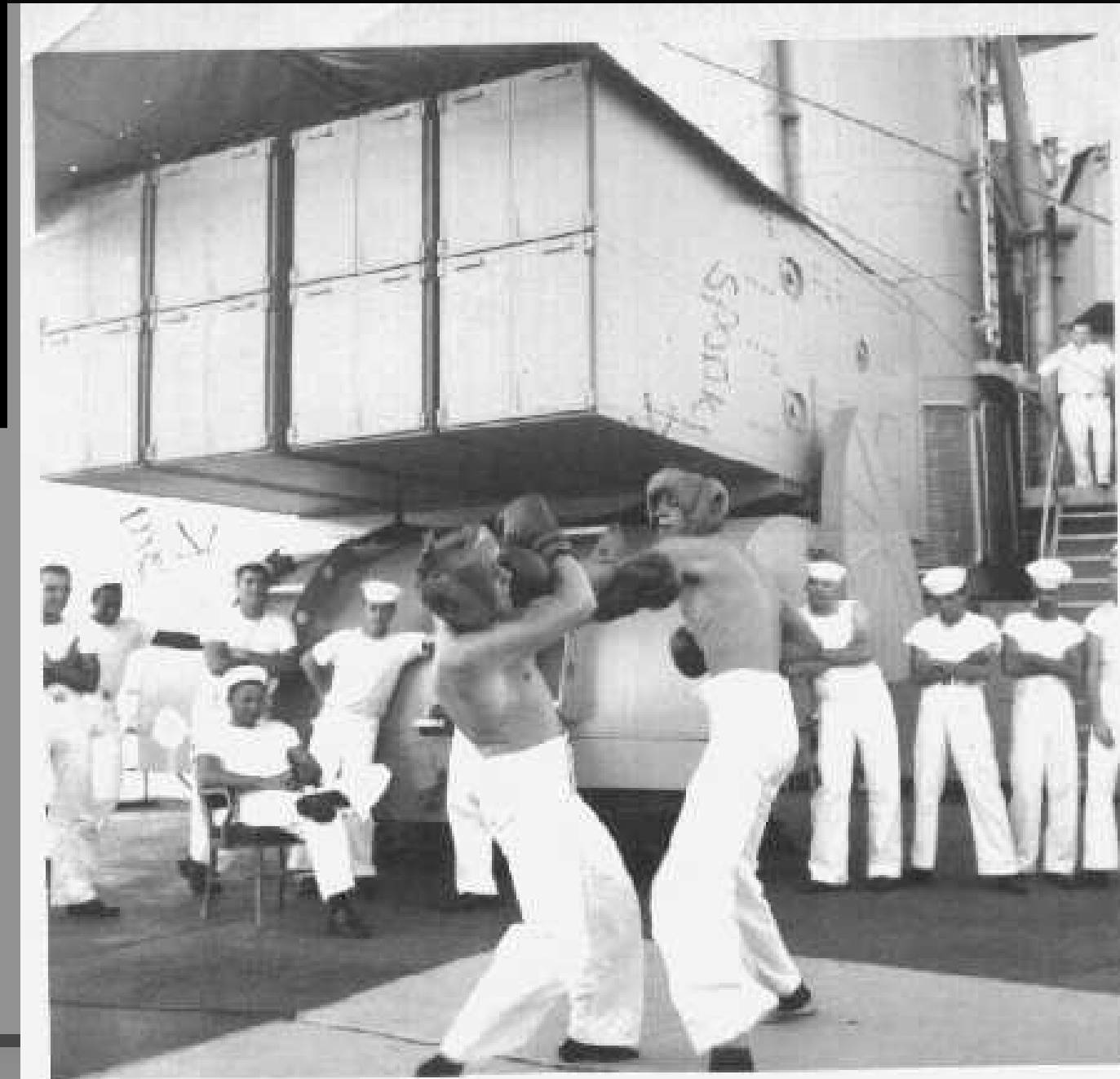
BARRY (DD 933)





Boxing

Match ?



Kinetic Energy Weapon

- Potato Gun

And now.....
The Mother of all
Weapons

TOMAHAWK!



TLAM

- TLAM A – (TLAM N)
- TLAM B – (TASM)
- TLAM C
- TLAM D

Tomahawk





Weapons to come:

- VGAS
- ERGM
- Tactical TLAM
- DD 21

Questions?

